

Primitive asteroids in the solar system (C, P, D class and associated subclasses) are believed to have undergone less thermal processing compared with the differential (S class) asteroids. The S-class asteroids comprise the majority of the main-belt and near-Earth asteroid population. The C-class asteroids become the dominant class of the main-belt asteroids beginning at a heliocentric distance of 2.5 AU. The transition of the dominant class of asteroid from the Cs to the P class occurs near 4.0 AU, with the D-class asteroids being the dominant class at the distance of Jupiter's orbit, 5.2 AU. Telescopic spectra of C-class asteroids show effects of aqueous alteration products, produced when heating of the asteroids was sufficient to melt surface water, but not strong enough to produce differentiation. These features include a sharp blue-UV turnover beginning at wavelengths shorter than 0.55  $\mu\text{m}$ ; the edge of a sharp UV charge transfer absorption seen in phyllosilicates (clay silicates having a sheet-like texture); absorption features attributed to  $\text{Fe}^{2+}$  -  $\text{Fe}^{3+}$  charge transfers in iron oxides present in phyllosilicates located in the visible/near infrared spectral region; and a deep absorption feature located from 2.6-4.0  $\mu\text{m}$  attributed to structural hydroxyl (OH) and interlayer and absorbed water ( $\text{H}_2\text{O}$ ) in phyllosilicates.

Absorption features in telescopic spectra of main-belt asteroids 1, 102, 368 and 877 and Cybele asteroid 1467 show similarities to absorptions seen in laboratory spectra of terrestrial serpentines and chlorites, and laboratory spectra of CM2 carbonaceous chondrite meteorites. Absorption features have also been identified in C- and P-class asteroids in the Cybeles ( $a=3.4$  AU) and some of the Hildas ( $a=4.0$  AU); however, no analogues exist for these spectra among spectra of the known meteorites. Spectra of 10 additional asteroids, all located in the outer belt, show no indication of these absorption features. These 10 objects include all of the Trojan asteroids (asteroids at the greatest heliocentric distance in this study) and all of the D-class asteroids (asteroids generally considered to have the most primitive composition) studied. These spectra suggest that aqueous alteration terminated in the outer belt and did not operate at the distance of Jupiter's orbit (1). These studies are consistent with observations of the presence or absence of the 3.5- $\mu\text{m}$  water of hydration absorption in the infrared spectra of outer-belt asteroids (2).

(1) F. Vilas and M.J. Gaffey (1989). Phyllosilicate absorption features in main-belt and outer-belt asteroid reflectance spectra. *Science* 246, 790-792.

(2) L.A. Lebofsky, T.D. Jones, P.D. Owensby, M.A. Feierberg, G.J. Consolmagno (1990). *Icarus* 83, 16-26.